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Home Security System using Arduino Nano and GSM

Vaibhav Balpande¹, Sneha Vanjare¹, Gunjan Malviya¹, Shailendra Parihar¹, Ritik Barange¹,
Ruchi Kadwane²

U.G. Student, Department of Electronics & Communication Engineering, SBITM College, Madhya Pradesh, India¹

Asst. Professor, Department of Electronics & Communication Engineering, SBITM College, Madhya Pradesh, India²

ABSTRACT: The need for home security alarm systems nowadays is a serious demand. As the number of crimes are increasing every day, there has to be something that will keep us safe. We are all aware of the high end security systems present in the market but they are not easily available to everyone. We therefore intend to provide a solution by constructing a cost efficient electronic system that has the capability of sensing the motion of the intruders and setting off the alarm. The basic idea behind this project is that all the bodies generate some heat energy in the form of infrared which is invisible to human eyes. But, it can be detected by electronic motion sensor. The project involves the use of Arduino Nano, motion sensor, buzzer, LCD display and a simple program. The sensor detects any motion in its permissible range and triggers the alarm. It will also send the signal to Arduino which processes the signal and sets off the alarm along with detection message on display as well as to mobile phones. With this system we can easily set up a security alarm in our home for unwanted intruders.

KEYWORDS: Arduino Nano, GSM, PIR sensor, LCD, Security.

I. INTRODUCTION

In our day-to-day life crime is increasing rapidly, so one of the important things is the security of our home, office, and shop from thieves/burglars. There are different types of home security systems available in the market including several security features like fire, LPG, electronic door lock, heat, smoke, temperature etc.

In this project, we have designed a Home Security System using PIR sensor and GSM module which detects intruders and informs the owner. This system/device detects thieves/burglars when they try to enter the house and informs the owner by sending text messages on her/his phone.

For this project we must have:

- HC-SR501 (Passive Infrared) PIR Sensor
- Interfacing PIR Sensor with Arduino | Motion Detector using PIR Sensor
- SIM800L GSM Module.

This GSM Based Home Security System project can be implemented on a very simple concept and it's very easy to build. The fundamental components of this project are the PIR sensor, Arduino, SIM800L GSM Module, LED, and Buzzer. PIR sensor detects the motion of surrounding objects by sensing the difference in infrared or radiant heat levels emitted by that objects. It produces high output by detecting the movement of any objects or human body in front of it. Here it is used to detect thieves/burglars (any human beings). When someone comes in front of the sensor, it detects motion and provides a high output voltage. This output voltage goes to the Arduino. Here we use Arduino NANO which is the main microcontroller of this project, it controls the whole system.

When the Arduino reads this high output voltage, then it sends commands to the GSM module for sending a Text Message/SMS to a specific user's Mobile number. The Buzzer is working as warning indicators, which alert us when someone tries to enter the house. In today's world technologic advancement and automation, home automating system has made its mark and is also becoming one of the rapidly developing sector of application-based technology.

The past idea of a comfortable living has changed widespread since the advent of the digital and wireless technologies. Smart homes, or in simple terms, homes that are fully automated, pre-programmed to carry out some predefined tasks,

respond to certain situations and also change according to the needs of the user takes up the new definition of comfortable homes.

The smart homes are expected to perform tasks such as temperature control, lightning and entertainment control, security and emergency response and many such others. They are expected to be controlled and automated from near or from a distance. Among all these one of the main concerns of the people is the security. Everyone wants to live securely in his/her home. Security from various incidents like theft, burglary, invasion, and many more. Not only these but also people want security from various household accidents like gas leaks, fire, LPG (Liquefied Petroleum Gas) cylinder blasts and other such accidents[1]. Nowadays, it is almost a common site in the newspapers that robbery took place in a house, or miscreants barged into a house and committed offence against the women or even murder.

Not only these but also we find that the LPG gas cylinder (that is used for household cooking and is a common item in various part of the world) leaked, these leakage if caught on time can be easily stopped but if not then fire can easily break out. LPG gas blast can sometimes be so dangerous that it can damage an entire block of houses. Such situations are very dangerous and most of the time life threatening, not only to the person in the house but also to the persons living in the surrounding of the house[2]. Fire is not only caused by this but another common cause of fire is electric short circuit. Improper grounding or old and weary wires can most certainly cause short circuit which eventually breaks up into a fire.

Let's consider a situation most of the houses are equipped with mechanical locks, which is very easy for an expert thief to crack. In such a scenario a theft or a robbery can easily take place. But this project comes with a locking keypad which is not easy to crack into. Along with this all the windows and the doors are equipped with PIR sensors so that even in case of a break-in, an alarm would be sounded and a message will be automatically transmitted to the nearest police station[3].

This project consists of basic modules along with a GSM modem. The GSM modem is used to send the message to the respected authorities in case of emergency. The module consists of intruder checkers which consists of an array of PIR sensors to detect the presence of a person in the house.

II. RELATED WORK

In paper [4] an Arduino Uno based real time home security system using self-generated password protection scheme has been proposed. The main function of this security system is to detect the presence of human being and make the user alert about it whenever it is necessary, by sending text message to user's mobile phone-number, registered previously. In the primary stage, presence of any human being will be sensed by a Pyroelectric (PIR) motion sensor and after that, the person will have to enter the right password through a keypad. Paper [5] proposes smart home security system is based on GSM (Global System for Mobile communication) has been implemented with AVR (Atmega16 microcontroller). This system provides the theft detection and LPG gas detection notification to respective user smart phone and is based on two sensor mechanism these are PIR Motion sensor and MQ2 Gas sensor. GSM Module is the devices which can be used in many ways. It keeps you connected with others. Two GSM Module can also be Communicate at any time. Hence to keep the eye on the House, for the security purpose, this device can be beneficial GSM Module can send and receive messages to the owner and the system both [6].

The project involves the use of Arduino Nano, motion sensor, buzzer, LCD display and a simple program. The sensor detects any motion in its permissible range and triggers the alarm. It will also send the signal to Arduino which processes the signal and set off the alarm along with detection message on display as well as to mobile phones. With this system we can easily set up a security alarm in our home for unwanted intruders.

III. BLOCK DIAGRAM

Block Diagram:

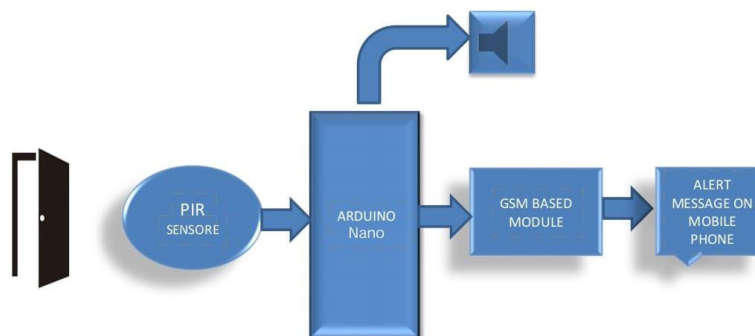


Fig.: Block Diagram

Above figure shows the block diagram of home security system, as we can see in above figure it consists of 4 major blocks like PIR sensor, Arduino Nano, GSM module, and an alert message block.

As we can see there is a door, the work of this block diagram is when someone enter in house and any other place where we placed this security system the PIR sensor detects the motion of that person who will enter by the door, after detecting the motion the PIR sensor send the signal to the Arduino Nano board.

After receiving the signal from the PIR sensor, the Arduino board start working according to the program we will implement in it and after processing it sends signal to GSM module and the GSM module send the alert message to the phone which will added in the program and with the same time there is a speaker which is added with the Arduino Nano board which is used to give a sound of alert signal.

IV. WORKING

This system is a basic motion activated alarm. It is built around an Arduino Nano. It is connected to a PIR motion sensor, a buzzer, a resistor, and a pair of external terminals. The whole system is battery powered so that it is easily portable. Once the system has the code, it can be connected to all the external parts. The easiest way to do this is with a breadboard then on PCB layout. This will let us to make temporary connections to test everything out. The system works on following steps:

- Step 1: Connecting the P.I.R sensor to Arduino
- Step 2: Connecting Buzzer, GSM To Arduino
- Step 3: Connecting L.C.D to Arduino
- Step 4: Programming Arduino
- Step 5: Drill Holes in the Housing
- Step 6: Glue the Motion Sensor and the Buzzer in Place
- Step 7: Close Up the Housing

V. RESULT & DISCUSSION

As we seen in the figure, the components are mounted on the breadboard for testing, because the main purpose of testing on breadboard is that, if any problem will occur then we can solve the problem manually by replacing the components, and if we directly mount the components on PCB and solder it and after doing that if any problem will occur then we cannot make any changes in it.

After testing on breadboard, we will mount our components on “Zero PCB” board. After successfully mount the components then connect with each other and solder it. Zero PCB is a basically a general-purpose printed circuit board,

also known as Dot PCB. It is a thin rigid copper sheet with holes pre-drilled at standard intervals across a grid with 2.54mm (0.1-inch) spacing between holes.

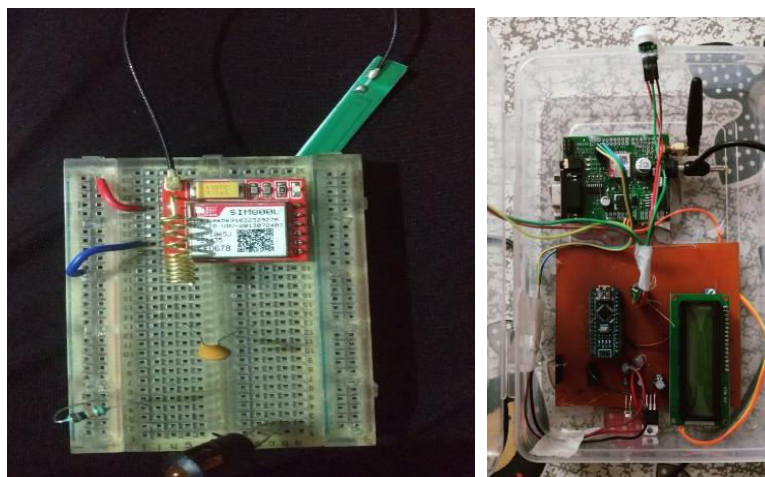
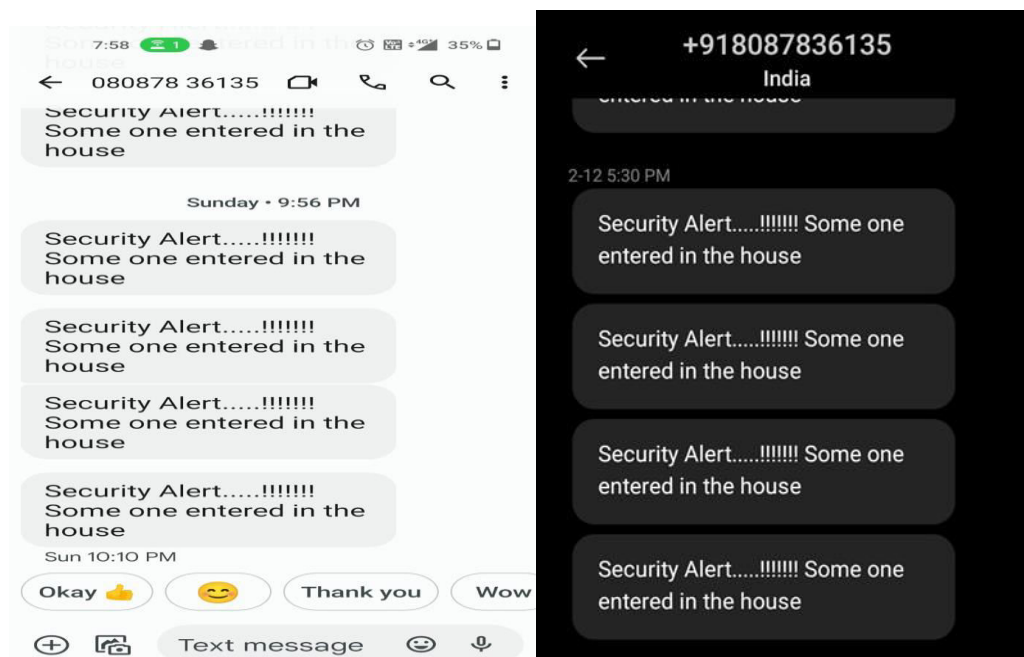


Fig.: (a) Bread board implementation (b) PCB implementation

After implementing and soldering all the components on the “Zero PCB” board we will add the Arduino IDE program using data cable. This program will be programmed such like that it can send the SMS message on the mobile number; the SMS will be like this “Security Alert.....!!!!!! Someone entered in the house” and this SMS will be send on 2 mobile numbers at a same time, and with this there is a buzzer connected with a circuit which will make sound and indicate that there is someone who will entered in the house.



As we can see in above 2 images the SMS will be send on this mobile numbers, after receiving this SMS on our mobile numbers we will conclude that our components connection and Arduino IDE program will be right and our project is running.

VI. CONCLUSION& FUTURE SCOPE

In this project we learn about new software and components details. While using Arduino IDE software we learn about how it works and how we programmed it. The Arduino Nano is a open source microcontroller it works automatically when we programmed it by using Arduino IDE software. GSM module is a device that uses GSM mobile telephone and other equipment that communicates with mobile telephone networks, they use SIMs to identify their device to the network. The use of PIR sensor in this project is that it can detect the object and a person who is entered in other's property without permission, after detection it send the signal to Arduino and circuit start working.

Advantages

- The given system is handy and portable, and thus can be easily carried from one place to another.
- The circuitry is not that complicated and thus can be easily troubleshooted.
- The given system sets off a powerful buzzer, and it is effective as any other alarm system available in the market.

Disadvantage

- The given alarm system determines the presence of the intruder only, and does not determine how many persons are in there actually.
- The alarm activates only when the person cuts through the line of the PIR sensor.

Applications

This type of motion sensing alarm system can be easily employable for security purposes at banks, various offices and even for sensitive establishments such as for military. We can easily set up this system for household purposes.

FUTURE WORK

The project can be further upgraded by controlling the other appliances like light and alarms, if any threat is detected. Arduino relay board containing multiple relays can be used to switch on and off the peripherals (lights, alarm). We can add a keypad to arm or disarm the alarm. We can determine the position of the intruder and then send a SMS to the concerned authorities accordingly. The home security system using Arduino Nano and GSM module is further work in highly security appliances.

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 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



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